CLAIMS:

1. A method of forming a metal layer on a substrate, the method comprising:

pre-treating the substrate by exposing the substrate to excited species in a plasma;

exposing the pre-treated substrate to a process gas containing a metalcarbonyl precursor; and

forming a metal layer on the pre-treated substrate by a chemical vapor deposition process.

- 2. The method according to claim 1, wherein the substrate comprises a semiconductor substrate, a LCD substrate, or a glass substrate.
- 3. The method according to claim 1, wherein the pre-treating comprises:

creating a plasma from a pre-treatment gas including H₂, N₂, NH₃, He, Ne, Ar, Kr, or Xe or a combination of two or more thereof; and exposing the substrate to excited species in the plasma.

- 4. The method according to claim 3, wherein the creating further comprises energizing an inductive coil and/or a substrate holder.
- 5. The processing system according to claim 4, wherein the energizing comprises applying RF power between about 500 W and about 3,000 W at a frequency between about 0.1 MHz and about 100 MHz to the inductive coil and/or applying RF power between about 0 W and about 2,000 W at a frequency between about 0.1 MHz and about 100 MHz to the substrate holder.
- 6. The method according to claim 3, wherein the creating further comprises flowing the pre-treatment gas at a gas flow rate between about 1 sccm and about 1,000 sccm.

- 7. The method according to claim 3, wherein the creating further comprises providing a pre-treatment gas pressure between about 0.3 mTorr and about 3,000 mTorr.
- 8. The method according to claim 1, wherein the pre-treating further comprises providing a substrate temperature between about –30° C and about 500° C.
- 9. The method according to claim 1, wherein the pre-treating comprises exposing the substrate to excited species in a plasma for between about 5 seconds and about 300 seconds.
- 10. The method according to claim 1, wherein the process gas comprises W(CO)₆, Ni(CO)₄, Mo(CO)₆, Co₂(CO)₈, Rh₄(CO)₁₂, Re₂(CO)₁₀, Cr(CO)₆, or Ru₃(CO)₁₂ or a combination of two or more thereof.
- 11. The method according to claim 1, wherein the process gas comprises a metal-carbonyl precursor and H₂, N₂, He, Ne, Ar, Kr, or Xe, or a combination of two or more thereof.
- 12. The method according to claim 1, wherein the exposing includes flowing the process gas at a gas flow rate between about 10 sccm and about 3,000 sccm.
- 13. The method according to claim 1, wherein the exposing includes flowing the metal-carbonyl precursor at a gas flow rate between about 0.1 sccm and about 200 sccm.
- 14. The method according to claim 1, wherein the forming comprises forming a layer containing W, Ni, Mo, Co, Rh, Re, Cr, or Ru, or a combination of two or more thereof.

- 15. The method according to claim 1, wherein the forming further comprises heating the substrate to between about 250° C and about 600° C.
- 16. The method according to claim 1, wherein the forming further comprises heating the substrate to about 400° C.
- 17. The method according to claim 1, wherein the forming further comprises providing a process gas pressure between about 10 mTorr and about 5 Torr.
- 18. The method according to claim 1, wherein the chemical vapor deposition process comprises thermal chemical vapor deposition, atomic layer chemical vapor deposition, or plasma-enhanced chemical vapor deposition or any combination thereof.
- 19. The method according to claim 1, wherein the pre-treating, exposing, and forming are carried out in at least one processing system.
- 20.A method of forming a tungsten layer on a substrate, the method comprising:

pre-treating the substrate by exposing the substrate to excited species in a plasma, wherein the plasma is formed from a pre-treatment gas containing H₂, N₂, NH₃, He, Ne, Ar, Kr, or Xe or a combination of two or more thereof;

exposing the pre-treated substrate to a process gas containing a W(CO)₆ precursor; and

forming a tungsten layer on the pre-treated substrate by a thermal chemical vapor deposition process.

21.A processing tool for forming a metal layer, comprising:
a transfer system configured for transferring a substrate within the processing tool;

at least one processing system configured for pre-treating a substrate by exposing the substrate to excited species in a plasma and exposing the pre-treated substrate to a process gas containing a metal-carbonyl precursor to form a metal layer on the pre-treated substrate in a chemical vapor deposition process; and

a controller configured to control the processing tool.

- 22. The processing tool according to claim 21, wherein the substrate comprises a semiconductor substrate, a LCD substrate, or a glass substrate.
- 23. The processing tool according to claim 21, wherein the at least one processing system contains a plasma created from a pre-treatment gas containing H₂, N₂, NH₃, He, Ne, Ar, Kr, or Xe or a combination of two or more thereof, the substrate being exposed to excited species in the plasma.
- 24. The processing tool according to claim 23, wherein the at least one processing system includes a plasma source configured to create the plasma.
- 25. The processing tool according to claim 24 wherein the plasma source includes an inductive coil and/or a substrate holder.
- 26. The processing tool according to claim 25, wherein the plasma source is configured for applying RF power between about 500 W and about 3,000 W at a frequency between about 0.1 MHz and about 100 MHz to the inductive coil and/or applying RF power between about 0 W and about 2,000 W at a frequency between about 0.1 MHz and about 100 MHz to the substrate holder.
- 27. The processing tool according to claim 23, wherein the at least one processing system comprises a gas delivery system configured to flow the pre-treatment gas at a gas flow rate between about 1 sccm and about 1,000 sccm.

- 28. The processing tool according to claim 23, wherein the at least one processing system provides a pre-treatment gas pressure between about 0.3 mTorr and about 3,000 mTorr.
- 29. The processing tool according to claim 21, wherein the at least one processing system provides a substrate pre-treating temperature between about –30° C and about 500° C.
- 30. The processing tool according to claim 21, wherein the at least one processing system exposes the substrate to excited species in a plasma for between about 5 seconds and about 300 seconds.
- 31. The processing tool according to claim 21, wherein the process gas comprises W(CO)₆, Ni(CO)₄, Mo(CO)₆, Co₂(CO)₈, Rh₄(CO)₁₂, Re₂(CO)₁₀, Cr(CO)₆, or Ru₃(CO)₁₂ or a combination of two or more thereof.
- 32. The processing tool according to claim 21, wherein the process gas comprises a metal-carbonyl precursor and H₂, He, Ne, Ar, Kr, or Xe or a combination of two or more thereof.
- 33. The processing tool according to claim 21, wherein the at least one processing system comprises a gas delivery system which causes the process gas to flow at a gas flow rate between about 10 sccm and about 3,000 sccm.
- 34. The processing tool according to claim 21, wherein the at least one processing system comprises a gas delivery system which causes the metal-carbonyl precursor to flow at a gas flow rate between about 0.1 sccm and about 200 sccm.
- 35. The processing tool according to claim 21, wherein the at least one processing system forms the metal layer containing W, Ni, Mo, Co, Rh, Re, Cr, or Ru or a combination of two or more thereof.

- 36. The processing tool according to claim 21, wherein the at least one processing system heats the substrate to between about 250° C and about 600° C while forming the metal layer.
- 37. The processing tool according to claim 21, wherein the at least one processing system heats the substrate to about 400° C while forming the metal layer.
- 38. The processing tool according to claim 21, wherein at least one processing system provides a process gas pressure between about 10 mTorr and about 5 Torr.
- 39. The processing tool according to claim 21, wherein the chemical vapor deposition process comprises thermal chemical vapor deposition, atomic layer chemical vapor deposition, or plasma-enhanced chemical vapor deposition or any combination thereof.
- 40. The processing tool according to claim 21, wherein the at least one processing system includes only one processing system.
- 41. The processing tool according to claim 21, wherein the at least one processing system includes at least two processing systems.
- 42. The processing tool according to claim 24, wherein the plasma source comprises a remote plasma source, an inductive coil, a plate electrode, an antenna, an ECR source, a Helicon wave source, or a surface wave source or any combination of two or more thereof.